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Comments: From the SCS Chief

New data show that conservation farming is less expensive than the other kind, in more places than we figured.

Soil and water conservation thus becomes more than just a good idea for the future and the folks downstream. It can save farmers money right now, as well as their soil and their productivity.

I hope that all SCS employees and conservation district leaders will join me in getting this kind of information to more people than we have ever reached before. We need to get out and talk to more landowners and operators.

The computer is helping us figure that conservation tillage, for example, costs \$3 or so less per acre to farm than conventional tillage on many soils. And the reduction in soil erosion is phenomenal—50 to 90 percent. In combination with other practices, it can do even better.

With the help of USDA's research, extension, economic, and financial-assistance agencies, we're going to develop more information like this—in order to help a farmer or rancher explore more ways of better agriculture and better resource protection . . . and in order to evaluate more fully what our programs accomplish and how to improve them.

These facts can help us do a better job as full-time persuaders for soil and water conservation. The result can be . . . must be . . . more conservation on the land and greater voluntary participation in USDA as well as State and local conservation programs.

The problems are there: Excessive soil erosion caused by water and wind hurt productivity on 1 of every 3 cropland acres in the United States.

The answers are there: We are still looking for more solutions, but we can help almost any landowner resolve a conservation problem without wrecking his or her balance sheet.

The interest is there: Most farmers and ranchers would like to be careful stewards of their land, if they could find a better way and be able to afford it. Many more news media people are interested today in helping spread the word about resource problems and what can be done to solve them.

Farmers who have saved money and headaches by conservation farming may well be our best advocates. As Will Rogers said, "If you've done it, it ain't braggin'."



Cover: Many communities in the water-short West are working to improve their irrigation systems. See articles from Arizona, Colorado, and New Mexico on pages 8 and 9. (Photo, Tim McCabe, visual information specialist, Public Information, SCS, Washington, D.C.)

John R. Block
Secretary of Agriculture

Peter C. Myers, Chief
Soil Conservation Service

All programs of the U.S. Department of Agriculture are available to everyone without regard to race, creed, color, sex, age, or national origin.

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News Briefs

Secretary Block Announces 1983 Wheat Program

Secretary of Agriculture John R. Block announced a 20 percent acreage reduction program for 1983 crop wheat and advance wheat deficiency payments to those farmers who participate in the program.

"The reduced acreage program should strengthen wheat prices by limiting next year's harvest and the buildup of stocks," Block said. "At the same time, the program will increase long-term conservation on wheat land.

"Participation is voluntary, but only those farmers who enter the program will be eligible for price support loans, target price protection, and eligibility for the farmer-owned grain reserve," he said.

Block also said the U.S. Department of Agriculture is intensifying its wheat export efforts and expanding its export credit sales program.

He announced that acreage taken from production must be devoted to conservation uses.

Farmers participating in the 1983 acreage reduction program must reduce their wheat acreage for harvest by at least 20 percent from an established wheat base. If the farmer participated in the 1982 wheat program, the 1983 wheat acreage base will be the same as the 1982 base. For producers who did not participate in the 1982 wheat program, their 1983 acreage base will be the average acreage planted for harvest of the 1981 and 1982 crops.

To meet the conservation uses requirement, a farmer with a 1983 acreage base of 100 acres can plant no more than 80 acres of wheat for 1983 harvest. The remaining 20 acres must be devoted to conservation uses.

If farmers plant fewer than the permitted 80 acres, they will be permitted to devote fewer acres to conservation. For example, if only 50 acres are planted,

only 12.5 acres (25 percent of 50) will have to be devoted to conservation use.

The land taken from production and devoted to conservation must be eligible cropland protected from wind and water erosion. Acreage designated to meet the conservation requirement may not be mechanically harvested, and grazing will not be permitted during the 6 principal growing months.

In addition, Block also announced an incentive to divert eligible cropland for permanent conservation practices. If the producer incorporates permanent conservation practices, such acreage will be eligible as conserving use acreage for a 3-year period. The permanent conservation practice will be eligible for cost-share payments through the agricultural conservation program. This approach will permit farmers more flexibility in managing their total farm base for future year participation. It also reflects the Secretary's intent to introduce more conservation incentives into the annual commodity program.

National Endowment to Aid Conservation Effort

Alarmed by the growing rate of soil erosion and by increasingly scarce water resources, which threaten our agricultural economy, a coalition of corporations, associations, and individuals announced the formation of the National Endowment for Soil and Water Conservation.

Emmett Barker, president of the Farm and Industrial Equipment Institute of Chicago, is serving as chairman of the endowment's provisional board of governors. The National Agricultural Lands Center is administering the endowment with the help of a grant from the Chicago-based Joyce Foundation. The endowment began with \$50,000 and plans to raise \$1 million in its first year. It is a private, nonprofit organization that accepts tax-exempt contributions to help solve the Nation's soil and water conservation problems.

When the endowment raises \$500,000,

contributors will elect a formal board of directors. The endowment will distribute this money through grants, cost-sharing, and low-interest loans, depending upon the amount of money available. It will begin by funding conservation demonstration projects and will complement rather than replace current efforts.

Endowment officials are very interested in working with all who are involved in soil and water conservation. They are especially interested in working with local soil and water conservation districts and U.S. Department of Agriculture agencies such as the Soil Conservation Service, the Agricultural Stabilization and Conservation Service, and the Extension Service. They also want to help all Americans realize they share the responsibility for soil and water conservation with farmers and ranchers.

Those who contribute at least \$2,000 a year will be eligible to be board members; those who contribute less may serve on an advisory council. Even people who give \$1 will become associate members.

For more information or to send contributions, write to the National Endowment for Soil and Water Conservation, 318 Fourth Street, N.E., Washington, D.C. 20002, or phone (202) 546-7407.

Donald L. Comis,
assistant editor, *Soil and Water Conservation News*, SCS, Washington, D.C.

SCS Chief Comments on Endowment

"The Soil Conservation Service recently announced that it would welcome the help of volunteers who want to contribute their time, skills, and energy to the cause of soil and water conservation," said Peter C. Myers, chief of the Soil Conservation Service. "Now there is still another way for volunteers to play a role in protecting America's resources, through participation in the National Endowment for Soil and Water Conservation.

"This private organization provides business firms and industries, associations, and private citizens with an

opportunity to contribute financially to many needed conservation projects and to help plan those projects," he said. "Creation of the endowment underscores what we have been saying for a long time—that soil and water conservation is everybody's business."

New Program Certifies Soil Erosion and Sediment Control Specialists

The Soil Conservation Society of America (SCSA) has initiated a program in the United States and Canada to certify professional soil erosion and sediment control specialists.

The program identifies professionals with public and private agencies who are qualified for educational, scientific, and service activities in the erosion and sediment control field. It is administered jointly by SCSA and the American Registry of Certified Professionals in Agronomy, Crops, and Soils, Ltd. (ARCPACS).

Laws governing misuse of land and water resources and damages inflicted upon others by erosion and sedimentation problems have been passed in many States and Provinces. According to SCSA, these laws have created a need for the services of professionals trained in proper erosion and sediment control methods. Such professionals increasingly must be able to show evidence of their qualifications; the certification program is designed to supply such evidence.

Certification by SCSA and ARCPACS is based upon scholarly preparation, knowledge, and experience. A review panel, all of the members of which are certified under the program, passes on the credentials of each applicant for certification.

Details on the program and application blanks for persons interested in certification are available from SCSA, 7515 N.E. Ankeny Road, Ankeny, Iowa 50021, or ARCPACS, 677 South Segoe Road, Madison, Wis. 53711.

Purdue Offers Conservation Tillage Slide Set

The Agronomy and Agricultural Engineering Departments at Purdue University recently completed a slide-tape set with script on "Conservation Tillage for Corn and Soybeans." The set includes 86 slides, a script, and a cassette tape with audible signals for changing the slides. The narration discusses no-till sod planting, no-till double cropping, and the interaction of crop rotation and tillage system performance.

The slides highlight the effects of tillage systems on soil and water conservation, water quality, energy use, response to fertilization, plant growth and crop yield, economics of production, pest control, and performance of different soil drainage classes.

The slide set is well adapted for college and high school classes, and for farmer and industry audiences. The slide set with tape and script is \$30. This includes mailing charges.

Order from the Agronomy Department, Purdue University, Donald R. Griffith, Extension Agronomist, West Lafayette, Ind. 47907. Enclose payment for \$30 and make payable to the Agronomy Department.

Agriculture Census '82: Your Farm or Ranch Counts

As the February 15, 1983, deadline for the 1982 agriculture census nears, the Bureau of the Census, U.S. Department of Commerce, says anyone can get help with the forms from vocational agricultural instructors or local offices of the Farm Credit Administration or the U.S. Department of Agriculture, including the Soil Conservation Service.

The Census Bureau said these instructors and offices have guidebooks that explain the forms. The census has been conducted periodically since 1840, to measure changes in the size of farms, ownership patterns, and the amount and kinds of crops grown.

This year, the Census Bureau has simplified the forms, as recommended by farmers and ranchers. Data users, who helped redesign the forms, include farmer organizations, farm suppliers, and local, State, and Federal agencies. Almost all agricultural planners use information from the census to make decisions such as where to put marketing facilities or how to allocate railroad cars.

Maryland Gets New Cost-Share Program

Maryland's Governor Harry Hughes has signed a new law establishing the State's first cost-sharing program for the control of nonpoint sources of agricultural pollution. Up to \$5 million will be provided to farmers over the next 10 years to help solve pollution problems caused by sediment and animal waste.

Farmers in certain designated critical areas will be eligible to receive up to 87 1/2 percent in cost-share funds for best management practices (BMP's), not to exceed \$5,000 for any one project or \$10,000 for BMP's installed under a pooling agreement.

The State Department of Agriculture, including the State Soil Conservation Committee, and the Department of Health and Mental Hygiene will work together in formulating and administering the program. Soil conservation districts will be responsible for certifying that practices meet technical standards.

Funding for the program was provided by an amendment to the Water Quality Loan Act of 1974, which was originally enacted to help fund the construction of sewage treatment plants.

Kathy Gugulis,
public affairs specialist, SCS, College Park, Md.

Plant Materials Centers Make Heat While the Sun Shines

This winter, two Soil Conservation Service plant materials centers will turn to the sun for their heat and hot water.

The National Plant Materials Center (PMC) in Beltsville, Md., and the Big Flats PMC in Big Flats, N.Y., will use U.S. Department of Energy grants to convert two buildings at each center to solar heat.

One reason the Department of Energy chose the two PMC's as demonstration sites is because of their many visitors. The Big Flats PMC serves New York, Pennsylvania, and all of the New England States. Visitors include students, conservation district officials and cooperators, SCS employees, and many others who want to keep informed on the PMC's progress in testing new grasses, legumes, wildflowers, trees, and shrubs for use in conservation programs. The Pennsylvania Chapter of the Soil Conservation Society of America will hold its next annual meeting at Big Flats, partly to see the solar-heated buildings. SCS employees in Washington, D.C., will have an opportunity to visit the National PMC after its solar panels are installed and operating.

At the National PMC, separate sets of solar panels will heat the manager's home and an office building. At the Big Flats PMC, one set of solar panels will heat an office building and a workshop/warehouse building. Thermostats in all of the solar-heated buildings will turn on conventional heating systems whenever solar heat alone cannot maintain the desired temperatures.

Dominic Fetterer, an SCS realty specialist in Washington, D.C., said the panels will save about half the PMC's fuel costs. The hundreds of people, including farmers, who visit the PMC's each year will not only learn about plants that save soil but will also learn about a heating system that saves energy.

Donald L. Comis,
assistant editor, *Soil and Water Conservation News*, SCS, Washington, D.C.

A New Tropic Sun

One of the newest plants under the tropical sun is 'Tropic Sun.' A soil-amending, green manure crop recently developed by the Soil Conservation Service Hawaii Plant Materials Center (PMC) and the University of Hawaii, 'Tropic Sun' is sunn hemp (*Crotalaria juncea*). This newest release of the Hawaii PMC shows some strong plusses: It is rootknot nematode resistant and can reduce nematodes in the soil; it is a good weed suppressant; and tests show it is nontoxic to grazing animals and poultry, unlike some other members of the *Crotalaria* genus. Its sunny yellow flowers attract a variety of bee that is thought to be the main pollinator of passion fruit.

'Tropic Sun's' full range of adaptation is not yet known since most of the testing has been limited to Hawaii's conditions. Plant specialists, however, feel that Guam should be able to use 'Tropic Sun' and interest in the seed is shown from Pacific Basin areas including Singapore and Taiwan. In the continental United States, it would be adapted to spring and summer planting in the South and Southwest.

When farmers could buy chemical fertilizers at relatively low cost, they placed a lower priority on soil-improving practices such as green manure cropping. Time has proven that without these natural organic amendments, the risk of soil degradation becomes much higher. With chemical fertilizers becoming expensive, farmers are rediscovering that legumes used as a green manure crop supply a substantial amount of nitrogen for the next crop to be planted and improve the physical condition of the soil. At high plant population levels, 'Tropic Sun' can produce up to 147 pounds of actual nitrogen per acre (165 kilograms/hectare) at 60 days of growth. Organic matter yields of over 3 tons per acre (7 tons/hectare) air dry weight can be expected.

'Tropic Sun' is a vigorous grower that can reach a height of over 4 feet (1.2 meters) in 60 days when grown under favorable conditions. In Hawaii, it is adapted year round below 1,000 feet (300 meters)

elevation and in the summer it can be planted up to 2,000 feet (600 meters). 'Tropic Sun' does best in well-drained soils but adapts to a wide range of soils, from coarse to fine textured, and to pH's from 5 to 7. Irrigation should be applied as needed to promote rapid germination and growth. A minimum of 1 inch (25 millimeters) of moisture per week gives maximum growth; however, 'Tropic Sun' is quite drought tolerant and has produced a modest yield on a total of only 2 inches (50 millimeters) of moisture in a trial planting on Molokai.

Sunn hemp is generally considered a native of India. It is used quite extensively there for soil improvement, bast fiber, and occasionally for forage. It has been grown in Indonesia, Rhodesia, Malaysia, Taiwan, and China.

Seed of 'Tropic Sun' will be available through the University of Hawaii's seed distribution program. Breeder and foundation seed will be maintained by the SCS Hawaii Plant Materials Center on Molokai. For additional information, contact Robert J. Joy, Plant Materials Specialist, Hawaii Plant Materials Center, Soil Conservation Service, P.O. Box 236, Hoolehua, Hawaii 96729.

Larry Yamamoto,
soil conservationist, plant materials center, SCS, Hoolehua, Hawaii

RCA Symposium To Be Held

Farmers, agricultural scientists, and agribusiness leaders will attend a symposium in December in Washington, D.C., to review the status of our land and water resources, the use of soil and water conservation practices, and food and fiber production. Recommendations from the symposium, Future Agricultural Technology and Resource Conservation, will be used in meeting the requirements of the Soil and Water Resources Conservation Act (RCA).

Iowa State University will conduct the symposium as part of an agreement with USDA's Soil Conservation Service.

Conservation Tillage Goes West

by Nancy M. Garlitz

More and more dryland grain farmers and ranchers in the central coast area of California are working out their own brand of conservation tillage to save money, conserve soil moisture, and reduce soil erosion. In this part of the State where the topography ranges from nearly level to mountainous, where fields commonly are made up of two or three soil types, and annual rainfall ranges from 6 to 45 inches, conservation tillage programs have to be tailored to suit each farm. Among the leaders in designing these custom-made programs are George Work and Barney Johansing.

Work runs a 12,000-acre cattle and grain operation in southern Monterey County, and Johansing farms 4,000 acres in partnership with his brother, Peter, and father, Walter, in northern San Luis Obispo County. Work has used various forms of conservation tillage over the last 17 years, and Johansing will soon complete 2 years under a special conservation tillage project sponsored by the Agricultural Stabilization and Conservation Service (ASCS).

The common practice of grazing stubble and then plowing under any remaining residues leaves the soil surface bare much of the summer and fall and has led to estimated erosion rates of four to six times the tolerable soil loss limit in some central coast areas. "The top 6 inches of soil is the most abused resource we've got and taking care of it is long overdue," says Work.

When he started farming in 1960, Work borrowed a moldboard plow from his neighbor and started to plow the crop residues under. He says it cost him a lot of time and money to clean till his fields so one day he stopped his tractor and drove a stake into the ground. When he compared the yields from where he plowed the residues under and where he had left them on the soil surface, there wasn't any difference. Work says he put the money he saved by making fewer trips across the field into his soil fertility program and his yields got better and produced more residues to protect the soil.

"I'm not saying we didn't have prob-

lems," says Work, "but we didn't have the straw choppers or other equipment that's available today. Despite the problems, we saw the economic and erosion control benefits and stuck with it. Gradually, we worked out our own system; and as the equipment got better, it became easier." Today, Work is known statewide as a conservation tillage expert.

It was Work's reputation that made the Johansings seek him out in 1979 when they became concerned about soil erosion on the rolling hills they farm. "Work is considered the number one conservation farmer around here," says Johansing. "We saw quite a bit of soil erosion and we wanted to prevent it. You won't be farming very long if you don't look at erosion control." Work, who has been a director of the Upper Salinas Resource Conservation District (RCD) since 1970, steered the Johansings to the Soil Conservation Service office in Paso Robles for technical assistance.

SCS District Conservationist Boyd Desonia says, "At that time, all the information we had applied to other States. We had no conservation tillage research or field trial results for California."

"We read about what farmers were doing in the Midwest and tried to apply it to conditions here," says Johansing. "But we have mostly winter rains while the Midwest has mostly summer rains, and the chemicals and herbicides certified for use here are different. It was hard to correlate the two."

With technical assistance from SCS, the Johansings set up a conservation field trial. They have a control field where the number of tillage operations has been reduced as well as plots of further reduced tillage, no-till, and conventional tillage with all of the residues disked under. Desonia says that organic matter, soil moisture, soil erosion, yield, and other data from the plots will be used to build information on applying conservation tillage in the area.

Many local farmers and some from distant counties heard about the Johansings' efforts through workshops and news articles and began calling the SCS office for information. One thing led to an-



A farmer in the central coast area of California harvests barley on a reduced tillage field. Area farmers are trying various reduced tillage systems to save soil.

other and in 1980, ASCS set up the State's first special conservation tillage project which covers the 400,000 acres of dryland grain land in the Upper Salinas and Las Tablas RCD's. Under the special project, farmers following specific guidelines can receive \$7 per acre up to \$3,500 per farm per year to experiment with conservation tillage over a 3-year period.

Twenty landowners have signed up for the special project so far. One criterion that farmers must meet to qualify for the ASCS cost sharing is leaving a minimum of 1,500 pounds per acre of crop residues on the soil surface after seeding. Says Desonia, "To measure the residues we put a ring about 14 inches in diameter on the ground and clip or scrape up the residues within the ring. If the residues are dry, we weigh them; but if they are damp and have mud stuck to them, we put them in a bucket of water and stir with a big spoon. Then we dry them and weigh them. We calculate from that how much is left on the ground per acre. We use 1,500 pounds as the minimum because research indicates that is about the threshold amount of residue needed to significantly reduce erosion. If the farmers can leave more than 1,500 pounds, so much the better."

Work says, "When I started farming, I had ground that couldn't grow 1,500 pounds of residues per acre much less leave that much after seeding. The fertility level was so low I couldn't produce a paying crop." Now, Work has some fields where he leaves 4,000 pounds of residues per acre, grazes the stubble, and still leaves more than the minimum.

Many central coast farmers only grow crops on the tops and bottoms of hills, leaving the steep sides in grass. They commonly run cattle during summer fallow, letting them graze the grassy areas as well as the stubble. "Running cattle requires more management with conservation tillage," says Work, who has over half of his operation in cattle. "You have to get them off before they overgraze the stubble." Johansing runs about 70 head and says he may run more when he increases his no-till acreage. He says the

cattle seem to do less damage when the soil is not worked as much.

No two farmers enrolled in the special project are applying conservation tillage exactly the same way. Desonia says, "Farmers know how their ground works up better than anybody else. They know what equipment they have and when and where they have specific weeds. What we try to do is help them figure out their own type of system. The main thing is to get away from disking. Disking puts 50 percent of the crop residues under with each pass over the field."

Although they receive cost-share assistance for trying conservation tillage on only 500 acres, the Johansings are using some form of conservation tillage on 1,700 acres. "We started farming here 7 years ago," says Johansing. "We chiseled land for dryland barley for the first time 4 years ago and this year will make the third crop we've taken off. We're always changing the way we do things, always looking for a better, more efficient way to get the job done. We have about 300 acres of no-till barley and we're pret-

ty pleased with the results. We got a better net return from our no-till than from our conventionally tilled fields.

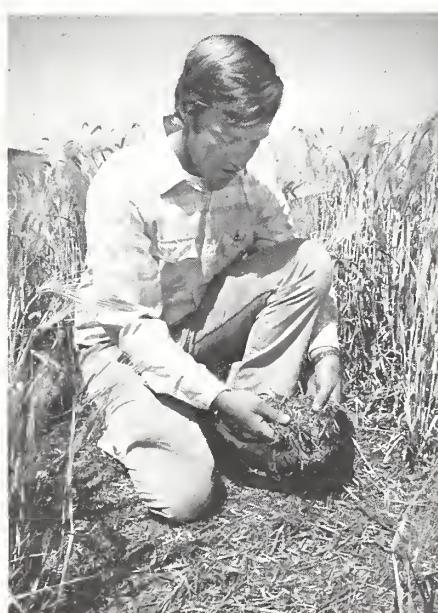
"A lot of your money is recoverable in no-till. If you have a bad rainfall year with conventional tillage, your investment in fallow work, which can be six trips across the field, is nonrecoverable. You lose most of the money you put into it except the fertilizer. With no-till, your only real costs are seed, herbicides for broadleaf weed control, and fertilizer. Your seed might be a loss, but the fertilizer and broadleaf control are still good."

"Our no-till cost \$35 an acre and our conventional tillage cost \$86 an acre. For us, no-till makes very good economical sense. It was a good year for it too with the late rains and we made money on it. Even so, I think we learned some things we can do to make it even better next year such as drilling the liquid fertilizer in with the seed. We expect to begin expanding our no-till acreage and maybe even go all no-till or at least to a rotation which includes no-till. We're taking chances, but we think it's an educated choice."

Work and the Johansings are pioneering conservation tillage, including no-till, in California. Many other area farmers are beginning to join them in making conservation tillage a coast-to-coast practice. Desonia reports that in the last 2 years, landowners have used some form of conservation tillage on 19,500 acres. That amount is likely to increase dramatically as SCS technical assistance and ASCS financial help is targeted to the central coast area in fiscal year 1983.

Nancy M. Garlitz,
associate editor, *Soil and Water Conservation News*, SCS, Washington, D.C.

Photos by June Davidek,
public affairs specialist, SCS, Davis, Calif.



Peter Johansing shows the mulch left on one of the family's no-till barley fields. The Johansings claim that no-till protects their soil and saves them money.

Improving Irrigation Systems

Now They're Pumping With Gas

Nine New Mexico farmers have joined together to reduce the cost of operating their irrigation pumps. Faced with the rapid price increase of fuel, the group put in their own natural gas pipeline in a highly successful project to reduce operating costs on their farms.

The farmers grow hay and grain in a well irrigation area west of Fort Sumner, N. Mex. Before they built their pipeline, they had to rely on diesel fuel and a dead-end natural gas pipeline from Fort Sumner, serving three homes and one farm, that was inadequate to meet their needs especially during peak demand periods.

Since the supply of natural gas was restricted, they called on El Llano Estacado Resource Conservation and Development (RC&D) Area Council, through the De Baca Soil and Water Conservation District, for help. Direct contacts and letters from the RC&D Council resulted in an okay for expansion of the gas service.

After the local gas company agreed to help, the farmers rented a trenching machine, provided a backhoe, and did their own work to install 9 miles of new line. This resulted in a continuous pipe loop system from the dead-end line, through their fields, and back to the Pecos River. The gas company then connected the system to the east side line to complete the loop.

Before the loop was installed, pressure in the two dead-end lines was often inadequate to meet the pump and household needs, especially during the irrigation season. The new loops resolved this problem and give service to both sides of the Pecos River at a constant pressure and volume level.

The nine farmers used their own money, energy, and equipment to make farming a more profitable business, and to make things a little easier for everyone. This is the underlying purpose of RC&D: to help people help themselves.

Thomas J. Anderson,
RC&D coordinator, SCS, Tucumcari, N. Mex.

Colorado Farmers Improve Water Delivery System

Farmers in Penrose, Colo., 25 miles northwest of Pueblo, are saving water by updating an irrigation system that was built in the early 1900's. The old system wasted up to half of the irrigation water as it flowed from the Pike's Peak watershed to the fields.

Most of the farmers work part time growing alfalfa, grass, and hay on 10- to 20-acre farms. These farms are in a 3,500-acre irrigated area, the largest irrigated area in Fremont County.

In the 1920's and 1930's, this area used to have many large orchards of red and golden delicious apples and sour cherries, but since then the orchards have almost disappeared. Recently, farmers have begun new cherry and apple orchards, with dwarf varieties of apple trees growing in meadow orchards. Some farmers are testing vineyards on a few acres.

The water for these crops is carried, first in concrete pipes then in an earthen ditch, downhill several miles from Beaver Creek, a tributary of the Arkansas River, to the Brush Hollow Reservoir. From the reservoir, it flows in a main earthen ditch to lateral ditches, which carry it to the fields of more than 350 landowners.

Water in the earthen ditches was seeping into the fractured limestone soil. In addition, water was leaking from the deteriorated pipes, which had been hand formed from local materials into short pieces joined with plaster.

In 1979, the Beaver Park Company, Inc., an irrigation company owned cooperatively by the Penrose farmers, began replacing the concrete pipe with plastic pipe and lining the main earthen ditches with concrete. The company is also replacing the lateral ditches with plastic pipe. So far it has lined 21,000 feet of the two main ditches and laid 15,000 feet of plastic pipeline. Last year, the company drained the reservoir and improved the control gates. About one-third of the planned work is finished.

Soil Conservation Service District Conservationist Roy Roper worked with the

irrigation company and the Fremont County Soil Conservation District to develop the long-range conservation plan the work is based on.

The company is paying for the work primarily with money borrowed at a low interest rate through the Colorado Water Conservation Board and with some additional help from Agricultural Conservation Program cost-share funds from USDA's Agricultural Stabilization and Conservation Service.

Concrete-lined ditches and plastic pipelines carry water considerably faster than earthen ditches. They also do not lose any water to seepage so they save water and reduce the amount of salts picked up underground and carried to the Arkansas River. The farmers expect to save enough water to be able to return more than 500 acres of abandoned cropland to irrigation.

This past irrigation season was the first in several years that began with a full reservoir at Brush Hollow. Roper said that this year's good snowpack in Pike's Peak should combine with the more efficient irrigation system to give Penrose farmers enough water for an extra irrigation during a dry period near the end of the summer when apples need enough water to set their buds for the next year's crop.

David Patch,
soil conservationist, SCS, Canon City, Colo.

Arizona Conservation Districts Modernize Irrigation Systems

The Yuma Natural Resource Conservation District (NRCD) in the southwest corner of Arizona has taken the first step toward renovating old surface irrigation systems. The systems carry water from the Colorado River to citrus fruits and other crops growing on the Yuma Mesa.

Water diverted from the Colorado River by the Imperial Dam flows 20 miles in a canal and then is pumped up to the Yuma Mesa, a sandy escarpment that rises about 70 feet above the Yuma Valley. There are almost 22,000 acres of surface-irrigated cropland on the mesa.

In 1978, the Yuma NRCD, in cooperation with local irrigation districts, asked the Soil Conservation Service to help it evaluate two irrigation systems, one built in the 1920's and another built in the 1950's. Together, they found that concrete-lined canals and ditches were cracked and other parts of the systems were leaking. Underground concrete pipes used in the older system were clogged and broken, besides being too small to irrigate efficiently. They found that farmers needed to remove the high and low spots in older citrus fields to create a uniform slope so water could flow evenly. They also found that farmers were wasting water by not monitoring soil moisture or measuring water used.

The Yuma NRCD published the results of the study in an easy-to-read booklet which it is using in its search for financial assistance to pay for an overhaul of both irrigation systems.

On the other side of the State, two small communities in a mountainous valley near the eastern border, did find the money to renovate a century-old irrigation system that services backyard gardens, hayfields, and pastureland. Their water comes from the nearby Little Colorado River, near the beginning of its journey northwest to the Colorado River.

The communities, Springerville and Eagar, use earthen ditches, built by the Mormons and other settlers, to carry this water. In the early 1970's, a local irriga-

tion district began trying to find a way to modernize one system. In 1975, the district asked the Apache NRCD and the Little Colorado River Plateau Resource Conservation and Development (RC&D) Area Council for help in planning a new system and finding money to pay for it.

In 1976, SCS measured water losses of about 75 percent from seepage, evaporation, and use by weeds in and around the system's ditch. Seepage from the ditch contributed to raising the water table and forming ponds in some areas. The ditch and nearby wet spots provided breeding areas for mosquitoes.

A few years later, when the final plans were approved, the RC&D Council provided cost-sharing funds which the irrigation district supplemented with other Federal grants and a loan from the U.S. Department of Agriculture's Farmers Home Administration.

Then the irrigation district asked for bids and awarded a contract for the work.

In September 1981, the contractor began replacing the ditch with an underground plastic pipe system designed by SCS. The pipeline has 16 valves that release water on the surface, at intervals along the pipeline. After the work was done, the contractor revegetated all disturbed areas.

This past irrigation season, the towns opened the valves on their pipeline and brought part of the Little Colorado River to their backyards, without wasting a drop on the way. This new pipeline is a small symbol of the modernization that awaits larger irrigation systems in Yuma Mesa and many communities in the West as they struggle to conserve a dwindling water supply.

Allen R. Powers,
district conservationist, SCS, Yuma, Ariz.

William H. Wood,
district conservationist, SCS, Springerville, Ariz.



Cracked, concrete-lined canals like this one plague old surface irrigation systems on the Yuma Mesa in Arizona. The Yuma Natural Resource Conservation District has begun a campaign to renovate the systems and increase irrigation efficiency on the mesa's 22,000 acres of surface-irrigated cropland.

CONSERVATION Research Roundup

Ozone Pollution Affects Crop Yields

Photochemical smog robs the Nation of at least a half a billion dollars of crops each year, possibly more than 2 billion dollars. It may be one reason why cotton yields have not improved since 1966.

Ozone in smog accounts for about 90 percent of all crop losses attributed to air pollution. It comes from a photochemical reaction between sunlight and the products of burning fuel, mainly from auto exhaust. Scientists say ozone levels in rural areas in the East are as high as in the cities.

In 1944, scientists saw that photochemical smog was damaging crops in the Los Angeles Basin. They say it forced some growers of truck crops, citrus fruits, and orchids out of business.

In the 1950's, scientists identified ozone as the most damaging ingredient in photochemical smog. In 1957, they discovered that ozone had damaged grape leaves in California. Dr. H. E. Heggestad, a plant pathologist with USDA's Agricultural Research Service in Beltsville, Md., noticed that the leaf damage of grapes was similar to that of cigar-wrapper tobacco in Connecticut and Maryland.

In 1958, Heggestad and scientists at the University of California at Riverside jointly published their finding that ozone was the cause of leaf damage on cigar-wrapper tobacco. This discovery moved the focus of the research from California to the East. Later, researchers in several States found ozone damaged many crop, forest, and ornamental species.

Heggestad found the levels of ozone existing in the Beltsville area produced significant changes in lint and seed quality in four of eight varieties of cotton tested in greenhouse experiments. Recent experiments in California showed that ozone reduced cotton yields by as much as 15 percent.

In 1972, Heggestad and his colleagues at Beltsville began using chambers with clear plastic walls and no tops, so the plants could grow under very nearly the same conditions as plants outside of the chambers. They pump the surrounding

air into the chambers, with and without a charcoal filter that removes much of the ozone. They have grown major varieties of several crops in these chambers.

Five years of research at Beltsville with snap beans showed scientists that a single exposure to a high concentration of ozone at blooming or early pod-filling time has a greater effect on yields than a relatively high average ozone concentration throughout the season. Sensitivity differences between varieties and seasonal changes in rainfall and temperature also greatly influenced the extent of yield loss.

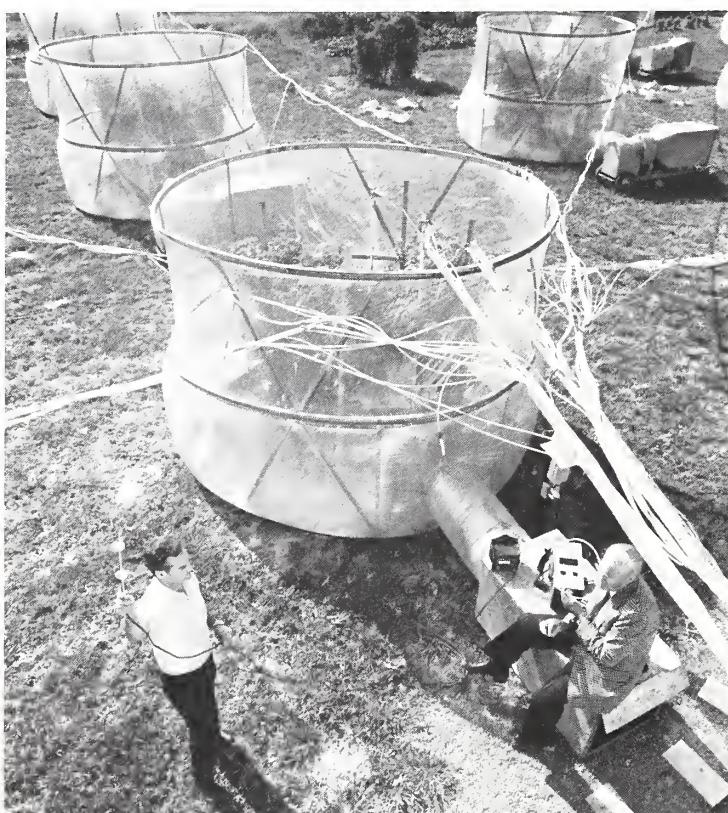
In 1979, they began adding sulfur dioxide, the second most common pollutant, in tests with tomatoes and snap beans. They found that sulfur dioxide and ozone act synergistically to injure snap beans at concentrations too low to cause injury as single pollutants. Heggestad first saw synergistic effects of ozone and sulfur dioxide on tobacco in 1966. In the more

recent study, he saw only additive, not synergistic, effects on tomatoes.

The scientists also found the mixture of ozone and sulfur dioxide lowered the yields of one snap bean variety without visibly damaging its leaves, as much as it lowered the yields of other varieties with visible damage.

Sulfur dioxide comes from the smokestacks of industrial plants. Scientists had known since the beginning of the century that sulfur dioxide damages plants. At that time it was a local problem, affecting only crops immediately downwind of smokestacks. Now that energy requirements are increasing, more power plants are switching to coal, and some smokestacks are 1,000-feet-tall, scientists are worried that sulfur dioxide could become a regional, if not a national and international, problem. For example, there is concern over acid rain in the Northeastern United States and in Canada.

What scientists do not know is exactly



Howard E. Heggestad (right), a plant pathologist with the Agricultural Research Service in Beltsville, Md., and Jesse Bennett, a plant physiologist, check atmospheric conditions outside special chambers where they are testing the effects of air pollutants on crop yields.

how much air pollution costs farmers each year. To find out, the U.S. Environmental Protection Agency formed the National Crop Loss Assessment Network in 1980, in cooperation with the U.S. Department of Agriculture, the U.S. Department of Energy, the University of California at Riverside, and the Boyce Thompson Institute for Plant Research, Ithaca, N.Y. To get answers quickly, they have focused on the effects of ozone on cotton, corn, peanuts, soybeans, tomatoes, and winter wheat at six laboratories in five States, including the Beltsville laboratory and two laboratories in California. Some studies involve exposure to mixtures of ozone and sulfur dioxide.

Last year, the Beltsville researchers began testing the effects of various combinations of four levels of ozone and six of sulfur dioxide on soybeans. This year, they are growing soybeans exposed to mixtures of five levels of ozone and three of sulfur dioxide, each with two levels of soil moisture.

Heggestad said, "It is the prolonged exposure to low levels of pollutants and mixtures of pollutants that concerns us most." He also said the immediate solution is for farmers in the East to choose only crop varieties that have been consistently high yielding in polluted areas.

Donald L. Comis,
assistant editor, *Soil and Water Conservation News*, SCS, Washington, D.C.

Reports Available on Plant Damage From Air Pollution

This year, Dr. Heggestad and other scientists presented their findings at a symposium on the effects of air pollution on farm crops. The Izaak Walton League of America has published their papers in a book titled, "Effects of Air Pollution on Farm Commodities: Proceedings of the Symposium, February 18, 1982." This book is available for \$11, prepaid, from the Izaak Walton League of America, Department A, 1800 North Kent Street, Suite 806, Arlington, Va. 22209.

The National Crop Loss Assessment Network's 1980 Annual Report is available for \$10.50, prepaid, from the National Technical Information Service, Springfield, Va. 22161. (Order No. PB 82-235-920.)

For more information on air pollution's effects on plants, ask for Report on Plant Diseases No. 1005, "Plant Damage from Air Pollution," available for 15 cents from Extension Plant Pathology, N-533 Turner Hall, 1102 S. Goodwin Ave., University of Illinois, Urbana, Ill. 61801. Checks or money orders should be payable to the University of Illinois.

5-foot pillows. All pillows, sitting on a 2-inch layer of sand, contain an anti-freeze solution. The pillows were covered with 2 inches of sand and then each pit was backfilled with its original soil.

As the weight of the moisture in the soil increases, it will increase pressure on the pillows, which will activate electronic equipment like that used in the SNOTEL (SNOWpack TELemetry) System. Data are transmitted to Master Radios at Ogden, Utah, or Boise, Idaho. Using a land leased line, the data are transferred to a computer at the SCS West National Technical Center at Portland, Oreg. This information then is available to Davis and Saxton by a phone call to Portland.

Saxton will compare the data generated by this method with that generated by lysimeters and neutron probes. The lysimeters measure the total quantity of water in a weighed soil tank 3 feet in diameter by 4 feet deep, and the neutron probes show the distribution of water within a given soil profile.

Because of their design, it is not practical to place lysimeters into a cropped field. However, should the snow pillow method or other similar sensors become effective and reliable, farmers and ranchers may be able to have these devices installed into their fields. Davis would be able to transmit the data via AGNET computers to any SCS field office AGNET terminal in Washington State, where farmers and ranchers would have immediate access to information about available soil moisture or other useful agricultural data.

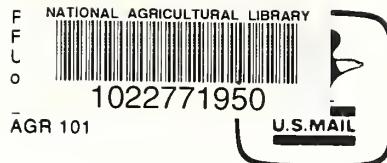
The research is just getting underway and it will take several seasons for calibration and verification of the data from the pillows.

Michael M. Price,
public affairs specialist, SCS, Spokane, Wash.

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New Publications

Land Use: A Spatial Approach

by John F. Lounsbury,
Lawrence M. Sommers,
and Edward A. Fernald

This 230-page book explores some of the most pressing domestic problems in land use, such as the decline of environmental quality, lack of sufficient recreational opportunities, improper use of hazardous areas, and random economic development. It is designed to serve as a text for courses dealing with land use and as a supplemental text for courses concerned with applied research, land planning, and environmental studies, both at the undergraduate and graduate levels.

Each chapter is written by an expert in that particular field and contains an introduction and a list of notes and references. Photographs, charts, and tables are used throughout the book.

This book is available for \$14.95 from Kendall/Hunt Publishing Company, 2460 Kerper Blvd., Dubuque, Iowa 52201.

What Shall We Do With the Land?

by Laurence Pringle

The author of this 152-page book has explored some of the conflicts between our need to use the land for today and our need to respect the land if it is to sustain our lives and those of future generations.

The book concentrates on the conservation of farmland, range-land, forests, wild places, and coasts.

Many photographs are used effectively throughout the text. A list of books for further reading on related subjects is included at the back of the book.

The author has written more than 35 other books for children and young people, many of which have been selected as outstanding science books for children by the joint book review committee of the National Science Teacher's Association and the Children's Book Council.

This book is available for \$9.50 from T. Y. Crowell Junior Books, 10 East 53rd Street, New York, N.Y. 10022.

Land Resource Regions and Major Land Resource Areas of the United States

by the Soil Conservation Service

This revised handbook (Agriculture Handbook 296) contains information that can be used in making decisions about national and regional agricultural concerns. It can be used further to identify needs for research and resource inventories, and it can serve as a framework for organizing and operating resource conservation programs.

A large map of the United States showing the major land resource areas is included in this publication.

Single copies are available from USDA, Soil Conservation Service, Distribution Section, Room 0054-S, P.O. Box 2890, Washington, D.C. 20013.

Water Repellent Soils: A State-of-the-Art

by Leonard F. DeBano

There is a worldwide interest in soil-water repellency. This report attempts to summarize information on this subject gathered from many documents. It should

not be considered definitive; several areas in water repellency are unsolved and require major research efforts.

This 21-page report focuses on the nature and formation of water repellent soils, kinds of water repellent substances, effects of soil-water repellency on water movement, fire-induced soil-water repellency, management problems and implications of water repellency, and future research needs.

Single copies are available from USDA, Forest Service, Pacific Southwest Forest and Range Experiment Station, P.O. Box 245, Berkeley, Calif. 94701. (General Technical Report PSW-46.)

Fertilizers and Fertilization: Introduction and Practical Guide to Crop Fertilization

by Arnold Finck

Both a basic introduction and a practical guide, this book is designed to be a source of information on fertilizer use worldwide. The fertilizers mentioned are mainly a selection of types widely applied in Europe, but are used along similar lines all over the world.

The author begins the book with an introduction and history of fertilization, followed by chapters on the properties and principles of application of fertilizers; fertilizers for soil improvement; correct amounts of fertilizer; and special fertilizer problems.

Included in the text are many tables and figures.

This book is available for \$42.50 from Verlag Chemie International Inc., Plaza Centre, Suite E, 1020 N.W. 6th Street, Deerfield, Fla. 33441.

Manual of Soil Laboratory Testing

by K. H. Head

This volume is the second in a series of three books designed to present current accepted laboratory practice in geotechnology. It is intended as a working manual for those involved in the testing of soils for building and civil engineering purposes. This volume covers standard laboratory tests for the measurement of soil permeability, bearing value, shear strength, compressibility, and related characteristics.

Volume 2 is a continuation of volume 1, from which the chapter numbering follows consecutively. It contains many photographs and drawings.

A third volume will cover effective stress triaxial tests of various kinds.

Volume 2 is available for \$39.95 from John Wiley & Sons, Inc., 605 Third Avenue, New York, N.Y. 10158.

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by the Soil Conservation Service

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Kentucky: Leslie and Perry Counties.

Louisiana: Madison Parish.

Michigan: Oakland County.

North Dakota: Bottineau County.

Ohio: Geauga County and Wyandot County.

South Carolina: Chester and Fairfield Counties.

Tennessee: Hamilton County.

Texas: Kimble County and Victoria County.